DESIGN AND IMPLEMENTATION OF TIRE PRESSURE MONITORING SYSTEM

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Abstract: Tire Pressure monitoring and maintenance in vehicles is an important task because the reduction in the pressure of the vehicles results in reduced fuel efficiency. Also, it leads to long-term wear in tires that results in the replacement of tires within a short span of usage. This paper focuses on the concept of monitoring tire pressure continuously. The prototype is developed using a pressure sensor and a wireless zigbee module embedded that eliminates the above-presented facts by into a micro-controller. To mount the pressure in the tire, a separate mouth is protruded apart from the normal mouth. The signal is read from the pressure sensor through the zigbee module and is transmitted to the microcontroller. The controller provides an alert message if the pressure in the tire is fall below the specified or the required limit. A LCD message will be displayed to indicate the user to correct the system and to ensure the safety of the vehicle. The wheel misalignment can be avoided if enough pressure is been maintained in the tire.

Keywords: Pressure sensor, Zigbee module, Microcontroller

1. Introduction

In recent days, the use of electronics plays a major role in Automobile to enhance the safety and comfort of using it. Autotronics is the new field been developed to state the specific use of electronics in different domains of automobile. Even nowadays many car accidents occurred due to low tire pressure not noticed by the users or drivers. Due to the under-inflated tires substantial number vehicle hit the road and creates accidents or a worse traffic tension. Vehicle Safety is ensured by implementing a new standard so called Tire Pressure Monitoring Systems (TPMS). In the new era, the vehicles are launched with advanced safety measures and one among this TPMS. The proposed system uses advanced techniques to provide a TPMS solution for the vehicle safety issue [1-4].

Few Years back and even nowadays pressure gauges are used to measure the tire pressure and if it is low below the set point tires will be filled with pressure. Due to the evolution of pressure sensors the recent tire pressure monitoring system is developed. There are three different configurations of tire pressure monitoring system exist. The proposed system is developed with a real-time pressure monitoring device and provides an alert message to the driver when there is necessity to change the tire. The inflated tires can lead to misalignment of wheels thereby even if brake is applied in a worse situation it may lead to accidents.[4-7]

The controlling device system of the whole systems is a Microcontroller. The project can be divided into two sub systems; one present in the tire which helps in sending current tire pressure through Zigbee based wireless communication. The other system is present in the car, which receives the current pressure and continuously monitors it. Also, it displays the pressure onto a LCD display. This system is capable of alerting in case of improper inflated tires. The provision of dynamic pressure setting is available in the car system. Microcontroller is loaded with an intelligent program written in embedded ‘C’ language to perform the task [8-15].

1.1 Layout of TPMS
2. Components Description

A. PIN DESCRIPTION MICRO-CONTROLLER PIC 16F73

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RA0/AN0</td>
<td>2</td>
</tr>
<tr>
<td>RA1/AN1</td>
<td>3</td>
</tr>
<tr>
<td>RA2/AN2</td>
<td>4</td>
</tr>
<tr>
<td>RA3/AN3/VEE</td>
<td>5</td>
</tr>
<tr>
<td>RA4/T0CKI</td>
<td>6</td>
</tr>
<tr>
<td>RA5/AN4/SS</td>
<td>7</td>
</tr>
<tr>
<td>VSS</td>
<td>8</td>
</tr>
<tr>
<td>OSC1/CLKIN</td>
<td>9</td>
</tr>
<tr>
<td>OSC2/CLKOUT</td>
<td>10</td>
</tr>
<tr>
<td>RC0/T1OS/T1CK</td>
<td>11</td>
</tr>
<tr>
<td>RC1/T1OS/CCP2</td>
<td>12</td>
</tr>
<tr>
<td>RC2/CCP1</td>
<td>13</td>
</tr>
<tr>
<td>RC3/CCPQ/SCL</td>
<td>14</td>
</tr>
</tbody>
</table>

Figure 3. Pin Diagram of PIC Controller

B. BLOCK DIAGRAM OF REGULATED POWER SUPPLY

Figure 4. Layout of RPS

C. Capacitors

The Capacitor or Condenser is a passive device, that stores energy in the form of an electrostatic field. Due to the electromagnetic field a potential (static voltage) across its plates is produced. A capacitor consists of two parallel conductive plates connected together, but are electrically separated by air or by an insulating material. It is called the Dielectric. If voltage is applied between the plates, current flows that charges up the plates with electrons. It turns one plate a positive charge and the other plate an opposite negative charge with equal amount. This flow of electrons is called the charging current. The output current is proportional to the voltage applied to the plates. The capacitor is said to be fully charged and this is illustrated below. Construction of a capacitor and an electrolytic capacitor are shown in figures 5 and 6 respectively[16-20].
The most common devices that is attached to a micro controller is an LCD display. The most common types of LCD’s connected to the many microcontrollers are of types 16x2 and 20x2 displays etc. It means 16x2 will be of 16 characters per line by 2 lines and 20 x 2 will be of 20 characters per line by 2 lines, respectively[21-24].

E. ZIG-BEE MODULE
Zig-Bee module has transmitting and receiving section. It can be connected to a microcontroller using two pins TX and RX. In this model Tarang F4 module is it works about 35 meter distance. The zig bee module transfers data wirelessly and the communication it can recharged too wirelessly. Fig: 7 shows Tarang F4 zigbee module.

F. PRESSURE SENSOR
A pressure sensor is used to measure pressure, typically of gases or liquids. Pressure is defined as the force required to stop a fluid from expanding, and is expressed in terms of force per unit area. A pressure sensor will be acting as a transducer and generates a electrical signal as a function of the pressure experienced. Fig 8 is the pressure sensor used in this project[16-19].

3. Project description
A. Circuit Diagram of transmitter Section
1. Transmitter section

The above schematic diagrams of Implementation of tire Pressure Monitoring System with wireless communication explain the interfacing section of each component with micro controller and Zigbee module. The pressure sensor detects the difference in air pressure in the
tire and sends the electrical signal through the zigbee module to the microcontroller that is been interfaced. The signal received by the microcontroller will be compared with the threshold limit and the buzzer will be on to indicate the reduction in air pressure in the tire. To avoid the wired connections the zigbee module interacts with the microcontroller to take necessary corrective action[20-23].

4. Conclusion

This project enables the driver who is riding the vehicle to constantly monitor the tire pressure. If the tire pressure falls below the required, it results in reduced fuel efficiency and seldom accidents. The factor of increasing fuel efficiency and regular maintenance of vehicle is directly addressed in this paper. Being an enhanced safety measurement, this process can be implemented almost in all vehicles present. Because of the fact monitoring pressure is of major importance successful implementation ensures comfort and safety in riding. Using highly advanced IC’s technology, the project has been successfully designed and implemented[24-30].

5. Future Enhancement

Since ICs are developed using advanced technologies the pressure sensor can be mounted on the rim or it can be placed inside the rubber tube. If it is so the tire pressure can be measured indirectly based on the load acting on the tire.

References


